Cabomba Tricolour

Anne Adams 1950-2011

Many of you reading this will have known Anne Adams and it is with heavy hearts and great sadness that we have to let you know that Anne died on February 15th 2011. Anne joined SSERC in 2001 having worked previously at Stevenson College and in industry. Anne was without exception thoughtful, supportive and caring of others and, despite many sadnesses in her life, she brought much joy and laughter to all of those with whom she had contact.

Anne was a consummate professional. 'Let's make those practicals work' was the title Anne chose for technician workshops and this could have been her mantra. She worked tirelessly to develop reliable and practicable experimental work, much of which is currently in use in classrooms across Scotland. Nothing was too much trouble for Anne whose technical expertise and friendly manner contributed significantly to SSERC's advisory service. Many teachers, technicians and senior pupils have benefited from her wise advice and huge sense of fun.

We at SSERC have enjoyed Anne's company for ten years and feel privileged to have worked alongside her and to be able to count Anne as a wonderful colleague and friend.

Whilst the Biology Group has responsibility for the contents of this article the practical work described would not have been possible the contribution of Anne.

Background

A significant proportion of the Biology Group in SSERC is old enough to remember using the textbook by McKean [1] when studying biology in their early years. One of the experiments recommended by McKean is the use of *Elodea* (Canadian pondweed) to investigate factors which affect the rate of photosynthesis. Some 40 years later, the same experimental system is still recommended in more contemporary texts. Whilst we do not subscribe to the view that one needs 'green fingers' to be successful when it comes to practical work in the classroom, we do recognise that experiments with *Elodea* often fall into the 'unreliable' category. Despite the difficulties often associated often with *Elodea*, many schools and colleges continue to use it with varying degrees of success. In a recent publication [2] we explored how *Cabomba* might be used as a reliable alternative to *Elodea* and we wish to extend these observations in the experiments described here. In the experiments that follow (described in more detail in a related publication [3]) we present an experimental set-up which provides a stimulating way of engaging students and we contend that this will lead to greater understanding that plants respire continuously and of the effect of light intensity on the rate of photosynthesis.

Materials and Methods

The aquatic plant *Cabomba* is available from most tropical fish suppliers as well as on-line [4, 5]; see the Science3-18 website for more information on maintaining your stock of *Cabomba* [6].

The light source used in these experiments was a 35 W fluorescent tube (product number 56427) purchased from Focus DIY although similar results can be obtained with a variety of light sources likely to be available in the school laboratory. We would recommend that you avoid lamps which might lead to significant changes in the temperature of the solutions. Transmission filters were obtained from Lee Filters [7].

A stock solution of hydrogencarbonate indicator is prepared as follows:

1. Cresol red (0.10 g) and thymol blue (0.20 g) are dissolved in ethanol (20 cm^3).

2. Sodium hydrogencarbonate (0.85 g) is dissolved in freshly boiled, cooled distilled water (approximately 200 cm^3) and combined with the ethanolic solution of cresol red/thymol blue and made up to 1.0 dm^3 with distilled water.

For routine use 100 cm^3 of the stock solution is diluted to 1.0 dm^3 with freshly boiled, cooled distilled water.

Results and Discussion

The use of hydrogencarbonate indicator to monitor CO_2 levels in aqueous solutions is well established [8].

Figure 1 shows how the colour of the indicator solution changes over the pH range 6.8 to 9.2.

One might predict that if some *Cabomba* were introduced into a solution of hydrogencarbonate indicator and irradiated for a sufficient period of time then one would see a colour change in the indicator as CO_2 is removed from solution. To test this hypothesis we set up 2 measuring cylinders containing a single strand of *Cabomba* and hydrogencarbonate indicator. Prior to illumination, the pH of these solutions was approximately 7.4 (orange) as shown in Figure 2A. Both cylinders were placed in front of the lamp for 4 hours of illumination. The photograph shown in Figure 2B is of a cylinder which was covered with black paper (and, therefore, received no light) during the illumination period whereas the cylinder shown in Figure 2C received 100% of the incident light.

The cylinder in Figure 2C has turned a purple colour because photosynthesis has taken place with a consequent reduction in the concentration of CO_2.